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DESIGNS FOR DAIRY BUILDINGS.

BY

ED. H. WEBSTER,
Chief of the Dairy Division.

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DESIGNS FOR DAIRY BUILDINGS.

By ED. H. WEBSTER,
Chief of the Dairy Division.

The great demand for information relating to the construction of dairy buildings led the Dairy Division of the Bureau of Animal Industry to start a line of investigation for the purpose of developing the basic principles of such construction. In order to make the work thoroughly practical, these studies were extended to the planning and actual supervision of construction of a number of dairy buildings in different sections of the country. The work is still in its formative stages and far from complete, but already promises valuable results in securing better methods of construction. In order to place the matter now available in form for wider distribution and usefulness, a number of plans are here presented, with brief descriptions. The designs are not intended to represent the only constructions advisable for the purposes indicated, but are intended to be suggestive of certain principles of construction which any architect or builder may use in designing a barn or other dairy building for a special location. No two locations will require or even permit of the same treatment so far as exposure, size, form, or building material are considered; but the problems of ventilation, cubic air space per cow, light, floors, ceilings, etc., are nearly alike in all cases. The designs shown represent feasible and inexpensive dairy buildings, planned by the Dairy Division and built in various sections of the country. Plans and specifications were furnished to builders, with the understanding that they would keep account of the cost of construction and furnish such other data as might be necessary for a complete description of the work.

A detailed description is given of one design only, but the principles are largely the same in all of the plans shown. This article will serve to illustrate the work done in this line during the year 1906.

STABLE FOR TWENTY-FOUR COWS.

The plan shown in figures 4 and 5 is designed for 24 cows, and allows ample room for calf pen and box stalls for bull and cows, also space for feed room, hay chute, wash room, and silo. The amount of space allowed for the various purposes will meet the usual requirements. The arrangement of the space can be adapted to the needs of the particular location.

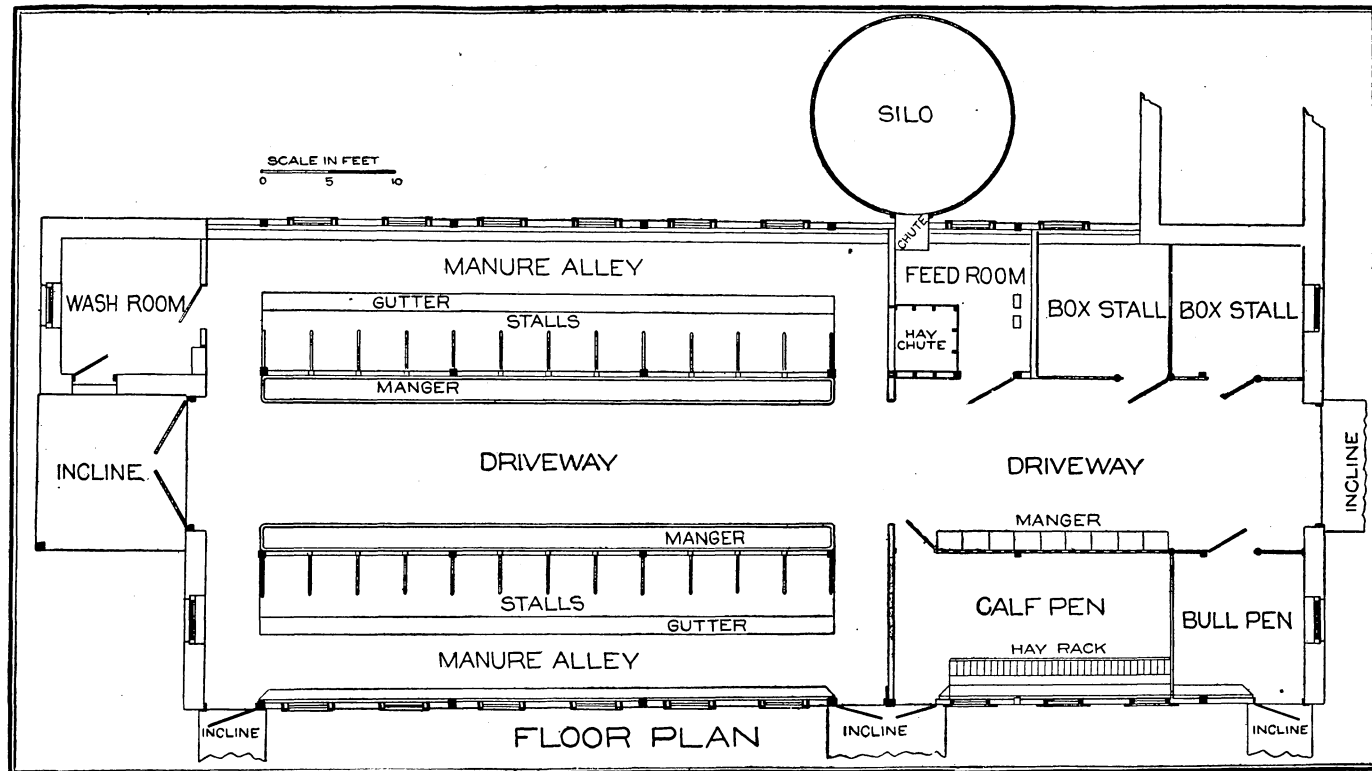


FIG. 4.—Floor plan of modern dairy barn for 24 cows.

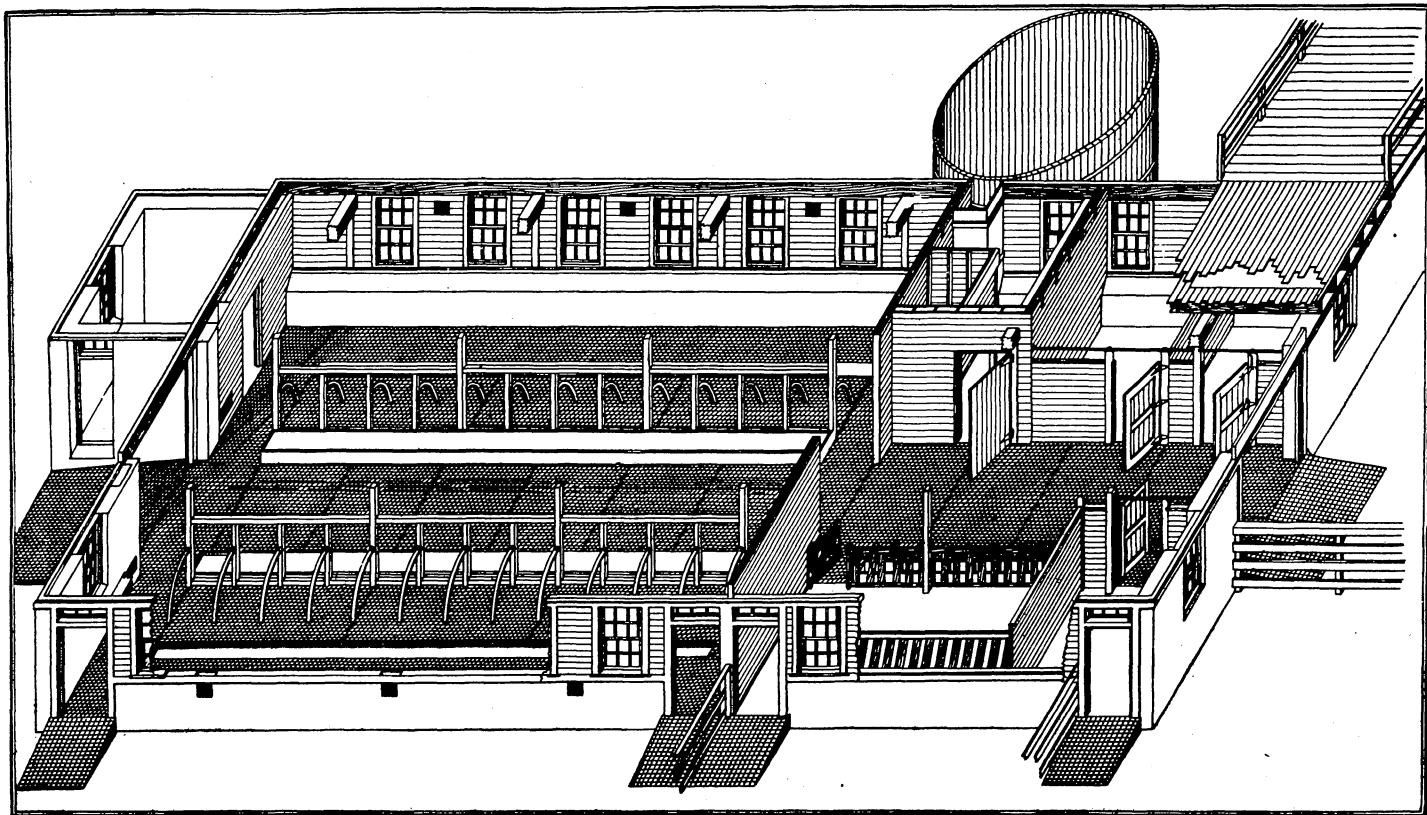


FIG. 5.—General view of interior of barn shown in fig. 4.

SPECIAL FEATURES COMMON TO ALL WELL-PLANNED BARN.

The width of this barn is 36 feet 4 inches outside. This allows ample room for the stalls and passageways, and permits of the most economical use of lumber in building. While the length here shown is 84 feet 9 inches, this depends on the number of cows to be handled. The side walls are built of stone or concrete up to the window sills, the balance of the walls being frame. The end walls are constructed of stone or concrete up to the ceiling. A partition extends across the barn so that the cow stable can be entirely shut off from the rest of the barn.

Posts and joists.—The posts carrying the upper floors are 6 by 6 inches, the girders 10 by 12, and the joists 2 by 12. If yellow pine is used, the joists should be spread 24 inches between centers, but if hemlock is used, the distance should be reduced to 16 inches.

Windows.—One of the weakest points in barn construction is the small amount of window space usually allowed. This plan provides approximately 6 square feet for each cow. It will be noted from the elevation that the windows are sliding sash extending to the ceiling, making them nearly twice as high as they are wide. This arrangement will admit much more light than the same space if the windows were placed otherwise.

Stalls.—The plan shows a width of stall of 3 feet 6 inches, which is as narrow as should be allowed. The depth is indicated as 4 feet 6 inches, but this may be varied according to the size of the cows in the herd. The manure gutter is 14 inches wide and 6 inches deep.

Manger.—The manger is planned to be 2 feet wide and 6 inches deep, with slightly rounded corners, the front sloping at an angle of 45 degrees and the bottom being 2 inches higher than the floor of the stalls.

Floor.—The entire floor is concrete, 6 inches in depth when finished, laid over at least 6 inches of cinders or broken rock. Concrete is considered the best material for a floor for several reasons: (1) It is the only material that is sanitary; (2) it is economical because of its durability; (3) when a reasonable amount of bedding is used it is comfortable to the animals and no bad effects result. The floor is intended to be raised about one foot above the level of the ground to insure drainage.

Alleys.—The alleys behind the cows are 4 feet wide. Manure should be taken away from the barn daily and deposited in a manure shed or on the field, and the alleys are designed with this in view. It is undesirable from the standpoint of construction and sanitation to have a manure pit under the stable.

Calf pen.—A comfortable calf pen should be provided, effectively separated from the milking herd. The one shown is 21 by 11 feet. Individual stanchions are provided for feeding calves grain and milk.

Bull pen and box stalls.—These are approximately 10 by 10 feet. There is a full window in each stall, providing an abundance of light.

Feed room.—This is centrally located; a chute from the silo enters it, also two grain chutes from the upper floor. A hay chute from the loft above deposits the hay in the feeding alley.

Wash room.—No dairy barn is complete without a wash room for the milkers and barn attendants, and lockers for their clothes. This room should also contain a small boiler for providing hot water and steam, as this is a necessary part of the equipment of a modern dairy barn. Milk scales, record sheets, milk stools, etc., may also be kept there when they are not in use.

Watering.—Watering devices may be put in the stable or provided for outside at the option of the builder.

Silo.—The silo planned for this barn is 14 feet in diameter and 32 feet high, and has a capacity of about 110 tons. This will provide silage for 24 animals for six to eight months.

Details of construction of stalls, stanchions, silos, etc., will be found later on, commencing with figure 19.

GENERAL VIEW OF INTERIOR OF BARN.

Figure 5 shows the construction of walls, floors, and partitions; also the location of doors and arrangement of stalls. The stalls are so designed that stanchions or chain ties may be used. Builders who desire to use patent stalls will find the arrangement of gutter, platform, and feed manger applicable to their use.

Storage of feed.—There is no objection to storage above the cow stable proper so long as the floor is similar in construction to the one in the drawing, so as to be kept perfectly tight.

Ceiling.—In colder climates it is deemed better to have a comparatively low ceiling on account of temperature, and this construction admits of changes in this respect.

Ventilation.—The plan adapts itself to any system of ventilation. The openings shown give a suggestion as to where the fresh air may be taken in and the impure air discharged.

Driveway to second floor.—This is located on one side of the barn, at the end. The main reason for locating the driveway at this point is because it does not shut out any light from the floor below.

SOUTHERN STABLE FOR TWENTY COWS.

Figures 6, 7, and 8 show a design prepared especially for southern conditions. The entire side walls are arranged in panels or doors, so that if desired the stable can be converted into an open shed. With ordinary construction of side walls, this plan is suited to any

climate. The lower chords of its scissors truss are used as ceiling joists on which smooth sheathing is laid, making a sanitary ceiling.

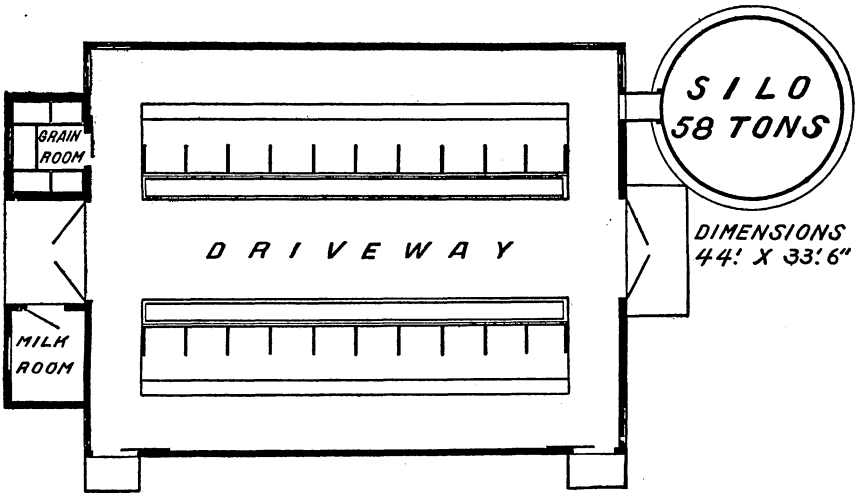


FIG. 6.—Floor plan of southern stable for 20 cows.

TWO-STORY STABLE FOR ONE HUNDRED COWS.

Figure 9 shows the floor plan and figure 10 the cross section of a two-story stable for 100 cows. Figure 10 also shows details of the

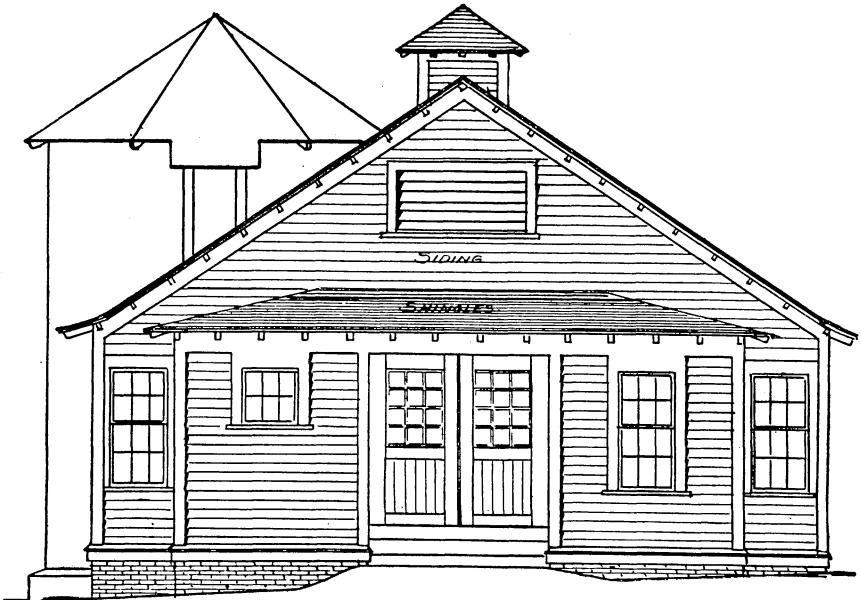


FIG. 7.—Front elevation of barn shown in fig. 6

provisions for extra ventilation by pivoted slats over the windows (A). These drawings also indicate the alternate arrangement of

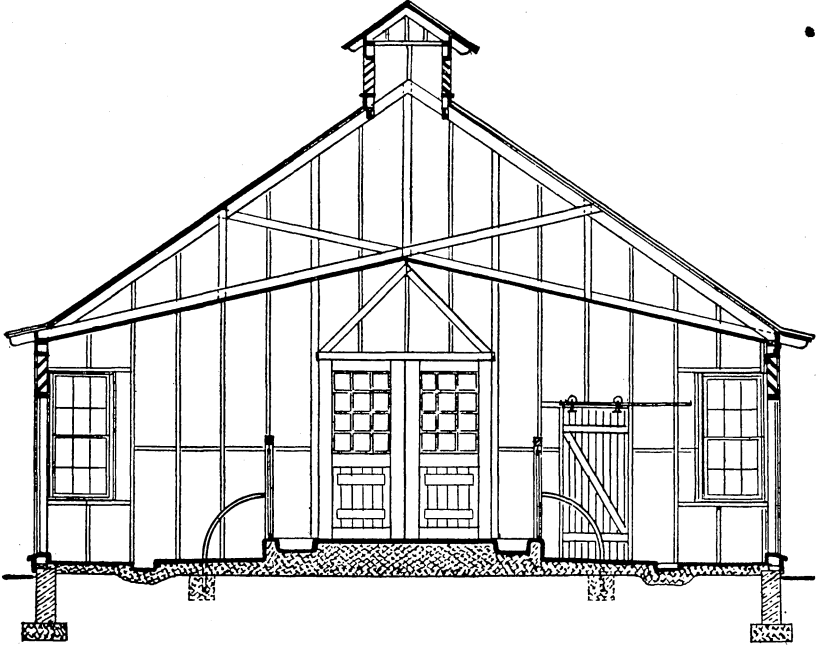


FIG. 8.—Cross section of barn shown in fig. 6, looking toward front.

stalls, the left side showing feeding alley in the center of the stable and the right side showing the manure alley in the center. Provision

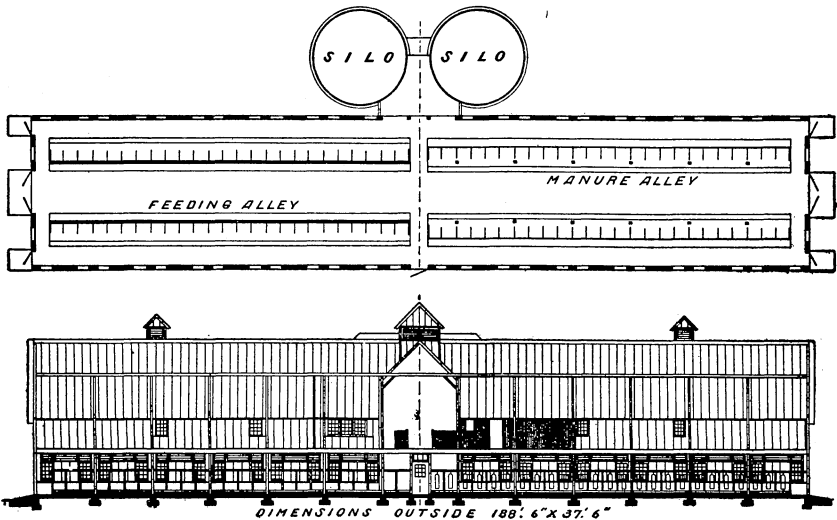


FIG. 9.—Floor plan and longitudinal section of two-story stable for 100 cows.

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is made for storage of hay and grain over the stable, with tight floor and ceiling for perfect separation. The King system of ventila-

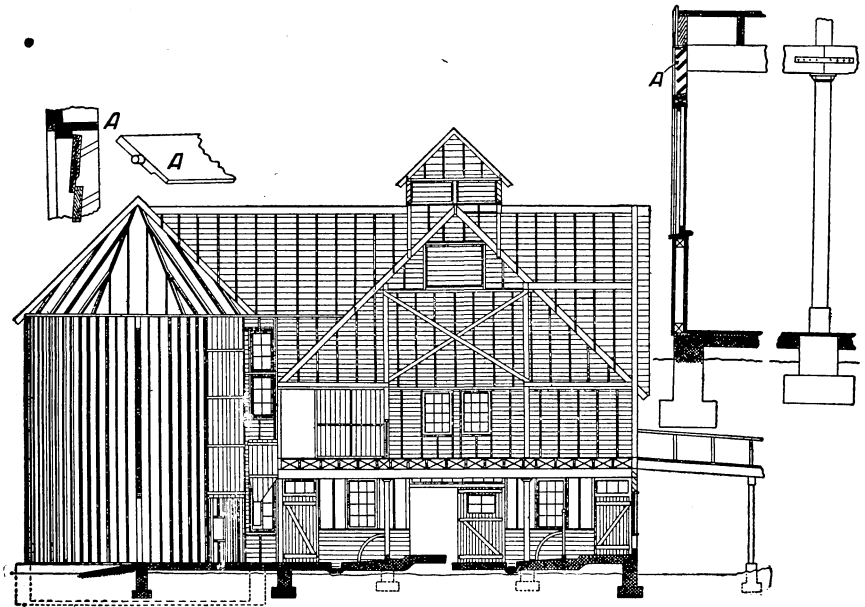


FIG. 10.—Cross section showing details of construction of stable shown in fig. 9.

tion can be installed in this design instead of the system shown, provided the walls are made sufficiently tight. Entrance to the second

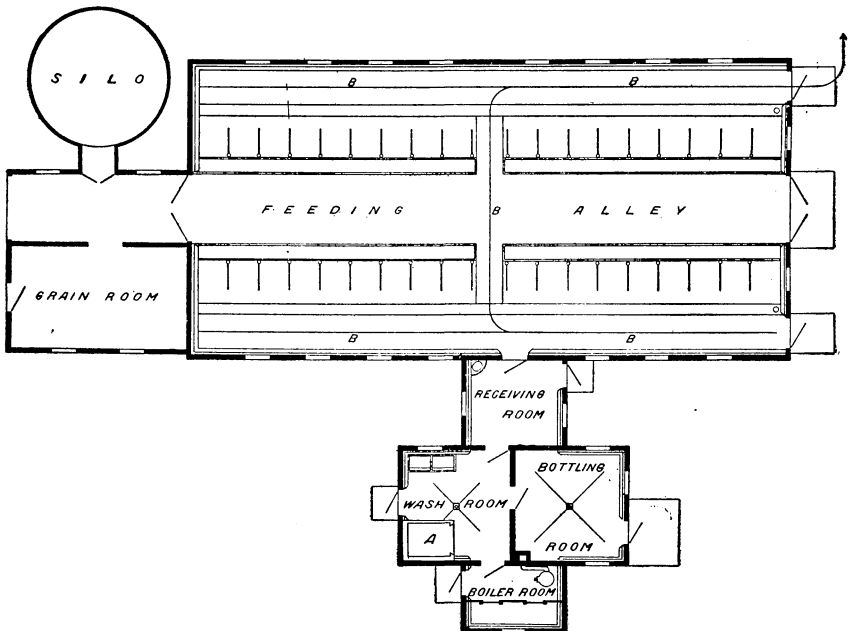


FIG. 11.—Floor plan of stable for 36 cows, with semidetached milk house.
[Cir. 131]

floor is by a central driveway over a bridge, avoiding any banking against the walls of the barn.

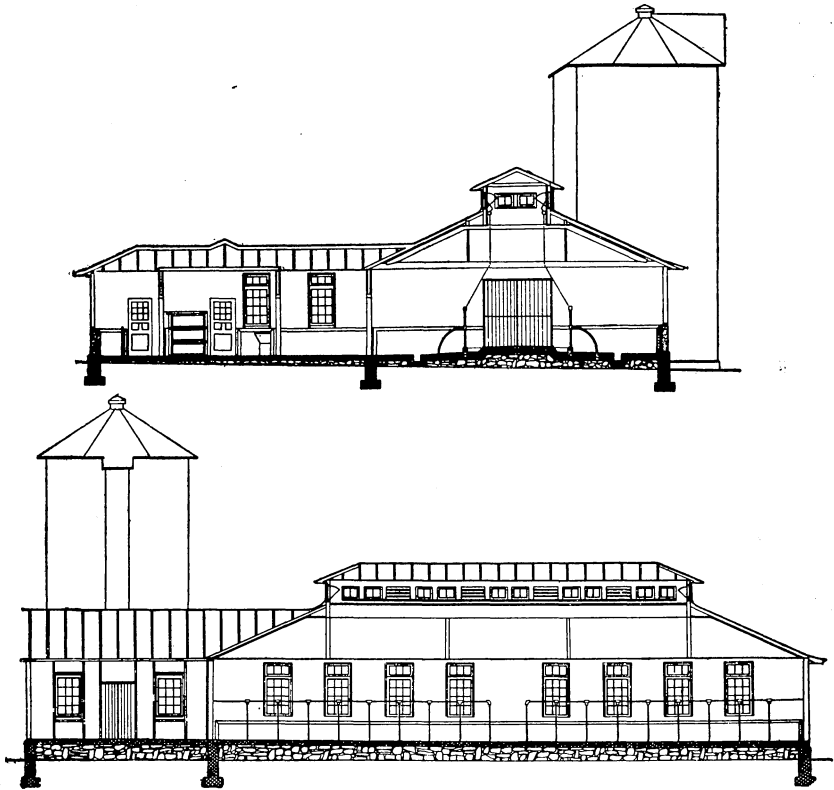


FIG. 12.—Cross sections of stable shown in fig. 11.

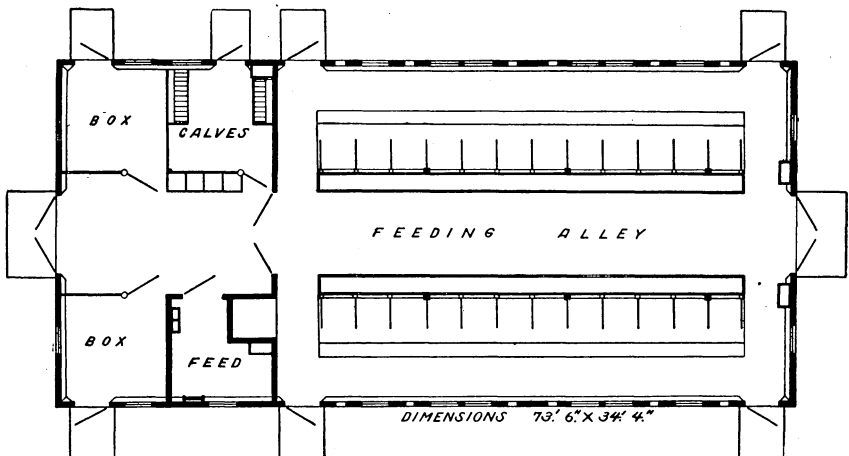


FIG. 13.—Floor plan of two-story stable for 24 cows.

STABLE WITH MILK HOUSE FOR THIRTY-SIX COWS.

Figures 11 and 12 show a design for a stable, with semidetached milk house, for 36 cows. In the floor plan (fig. 11) *A* is the steril-

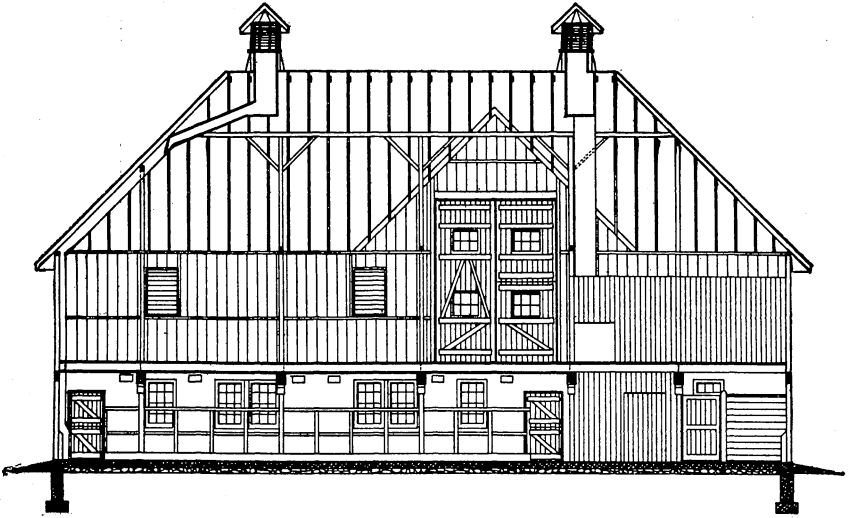


FIG. 14.—Longitudinal section of stable shown in fig. 13, showing system of ventilation.

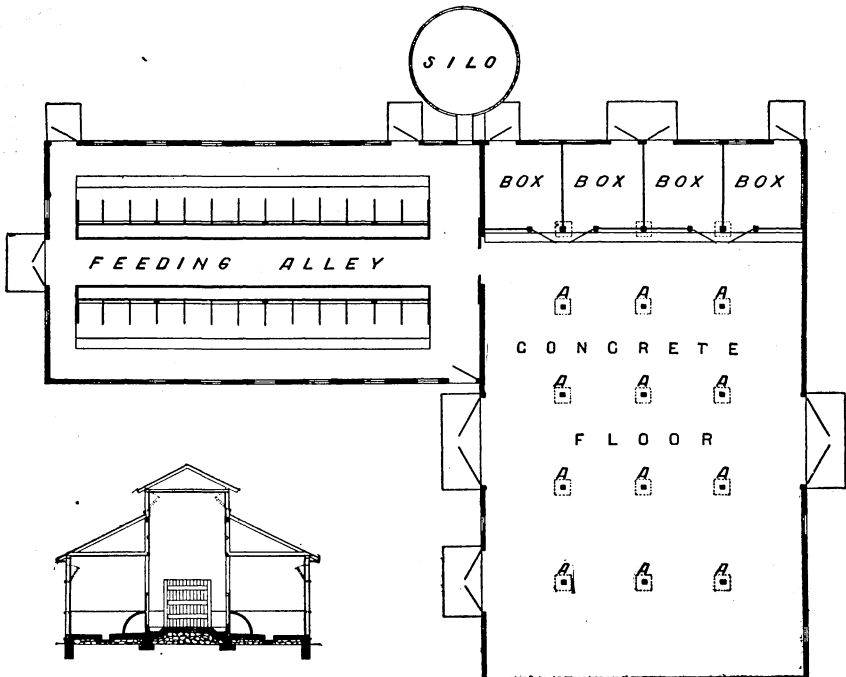


FIG. 15.—Floor plan and cross section of stable for 26 cows, box stalls, silo, and space for wagons and farm machinery.

izer and *B* is the overhead track for manure carrier. In the cross section (fig. 12), upper drawing, cords are shown by which the ventilating windows in the roof are controlled. It is expected that only cows in milk will be kept in this stable.

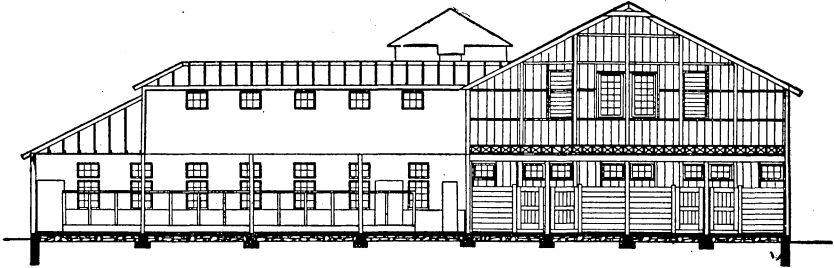


FIG. 16.—Longitudinal section of stable shown in fig. 15.

TWO-STORY STABLE FOR TWENTY-FOUR COWS.

Figure 13, floor plan, and figure 14, longitudinal section, show a design for a complete stable for 24 cows, with room for calves, feed, and forage. The construction is of the post-and-girt system. Ventilation is provided by the King system, two exhaust flues starting from each end of the stable near the floor and six inlets admitting air near the ceiling on each side.

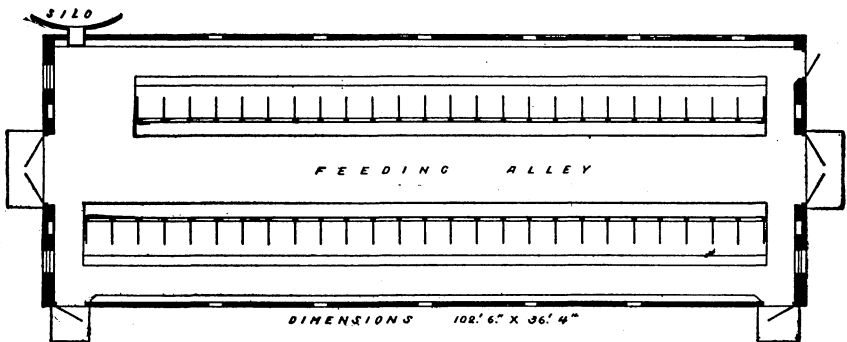


FIG. 17.—Floor plan of two-story stable for 50 cows.

COMBINATION BARN FOR TWENTY-SIX COWS.

Figure 15, floor plan and cross section, and figure 16, longitudinal section, show a design providing for 26 cows in the one-story wing, four box stalls for horses and space for wagons and implements on the ground floor of the main building, with storage for fodder and grain on the second floor. Ventilation is provided for by hinged windows under the eaves and in the clearstory. *A* shows the footings for posts for upper story.

TWO-STORY STABLE FOR FIFTY COWS.

Figure 17, floor plan, and figure 18, end elevation and detail of construction, show a design for the accommodation of 50 cows in a very

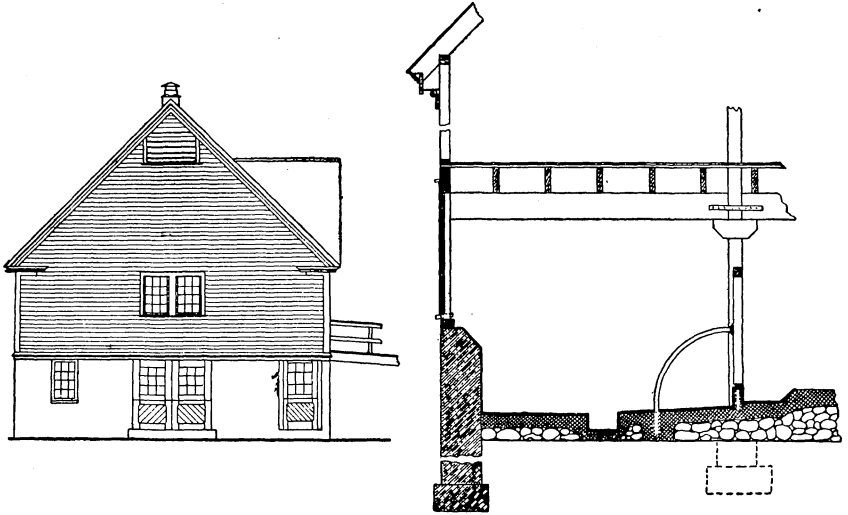


FIG. 18.—End elevation and detail of construction of stable shown in fig. 17.

simple arrangement for a strictly dairy herd, with storage on the second floor. The driveway to the second floor is at the center of the side under a cross gable and over a bridge from detached wall.

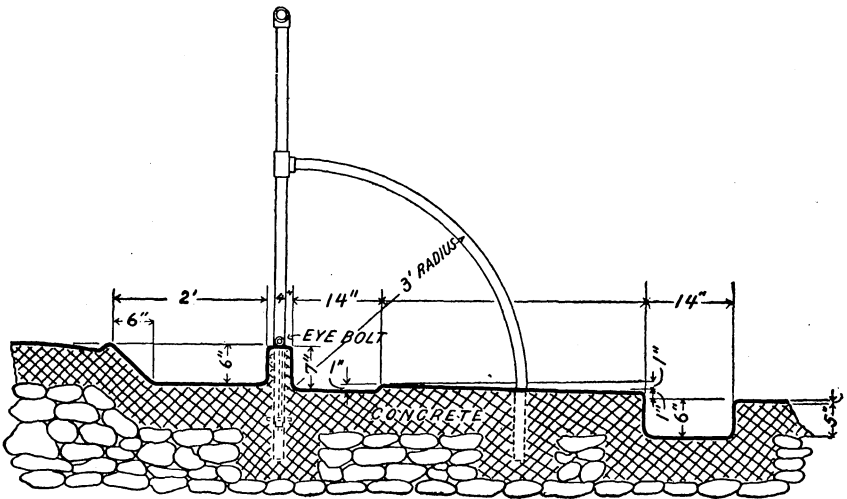


FIG. 19.—Sanitary stall construction with iron-pipe fittings and chain-hanging stanchions.
[Cir. 131]

CONSTRUCTION OF STALLS AND STANCHIONS.

Figure 19 shows detail of sanitary stall construction with iron-pipe fittings and chain-hanging stanchions. The dimensions are adapted

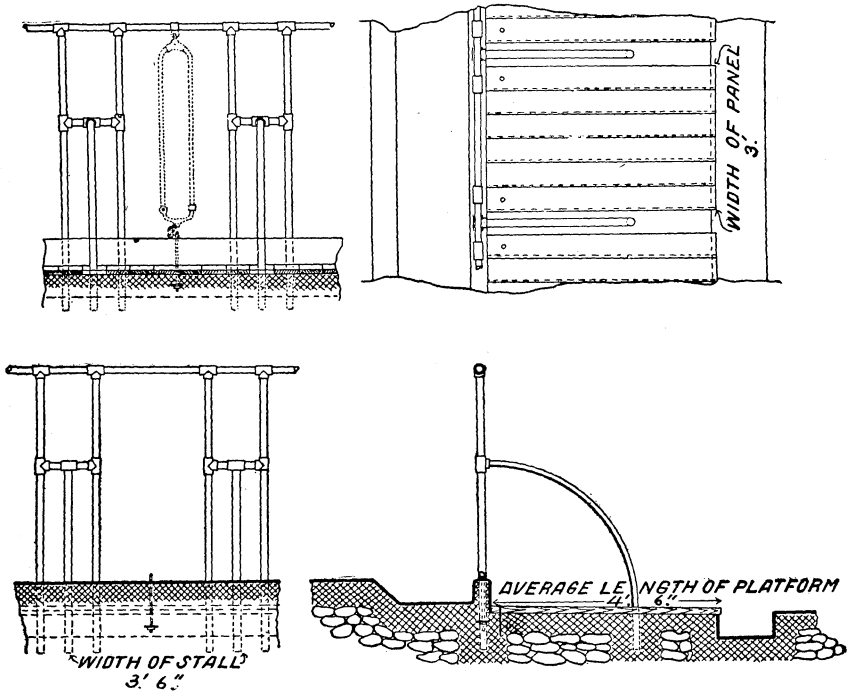


FIG. 20.—Stall with movable wooden floor and fastening for same.

to cows of average size. The depression of 1 inch in the front part of the platform enables the cow to stand level, helps to prevent her from slipping on the cement, and also helps to retain bedding in place.

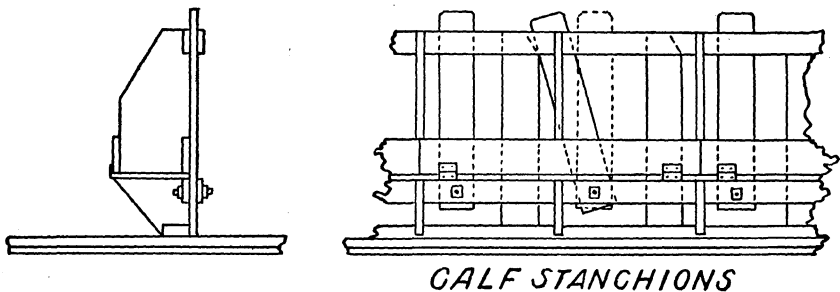


FIG. 21.—Simple and economical calf stanchions.

Figure 20 shows a similar stall provided with a movable wooden floor. The advantage of this design will be appreciated by those who find the cement too cold for the comfort of the cows during the northern winters. The wooden platform is kept in place by two iron pins set in the cement floor near the front corners of the stall. The floor panel is easily removed for cleaning.

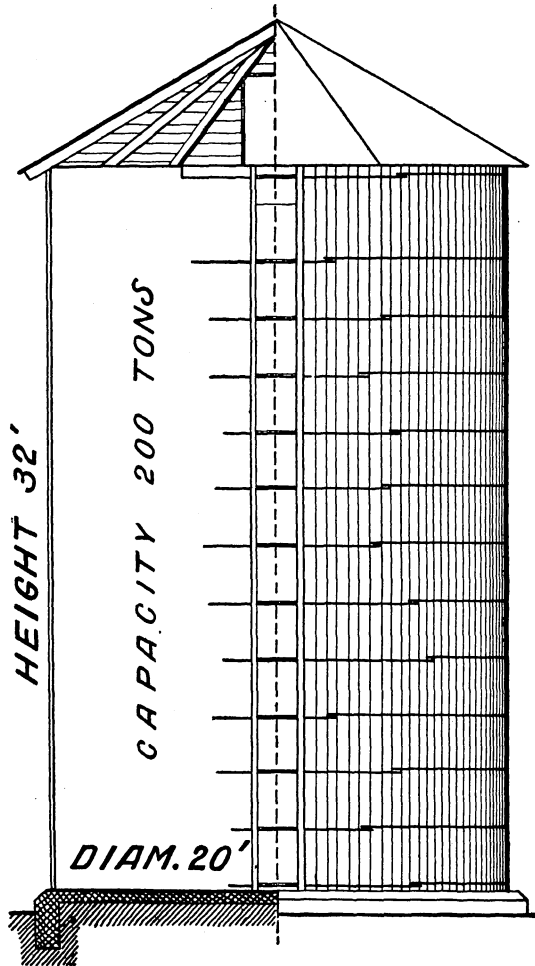


FIG. 22.—A 200-ton stave silo with continuous doors.

Figure 21 shows simple and economical calf stanchions which have been found convenient and satisfactory for feeding milk in pails and for feeding grain as well. The hinged front makes cleaning simple. The calves are to be confined only while feeding, being allowed the freedom of their boxes or pens at other times.

STAVE SILOS.

Figure 22 shows a 200-ton silo with continuous doors. The foundation wall is laid up from below frost line, and the cement floor covers the area within the foundation wall. The door posts are held in position by sections of iron pipe through which pass iron bolts.

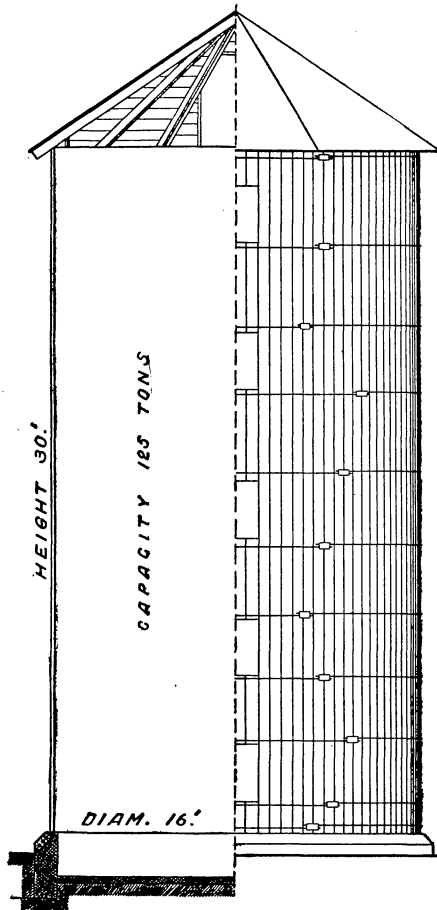


FIG. 23.—A 125-ton stave silo without continuous doors.

Figure 23 shows a stave silo of 125-ton capacity without continuous doors. The foundation wall should be reinforced by iron hoops or wire embedded in the concrete near the top if the wall extends more than 1 foot above the ground. In the erection of these silos the staves are spiked together at intervals of about 5 feet. A half-inch hole is bored to a depth of about 1 inch if staves are 2 by 4 inches, and to a

depth of 3 inches in staves 2 by 6 inches, to allow the countersinking of the nail heads so as to keep them within the stave after the usual shrinkage and to give the nail sufficient hold. This method avoids the expense of tonguing and grooving the staves and holds the silo firmly together when empty and dry.

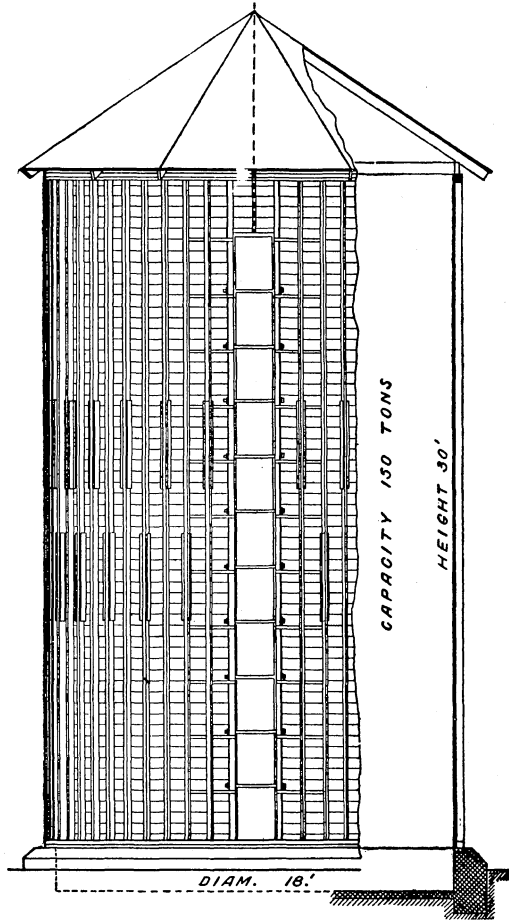


FIG. 24.—A 150-ton modified Wisconsin silo.

MODIFIED WISCONSIN SILO.

Figure 24 shows a modified Wisconsin silo of 150-ton capacity. The foundation wall rises from 2 feet below grade, or below frost line, to 1 foot above grade. Continuous doors are provided, as in figure 22.

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SILO WITH WOODEN HOOPS.

Figure 25 shows a 75-ton silo with wooden hoops. Four thicknesses of tough $\frac{1}{2}$ -inch lumber are used in building up the three or four hoops nearest the bottom, and three thicknesses for the rest of the hoops. The lining is of $\frac{3}{4}$ -inch matched lumber. The construction of doors is shown at the side of this figure. *A, A, A* are iron clips bolted to the door; *B, B* are the door posts; *C* is the wooden hoop.

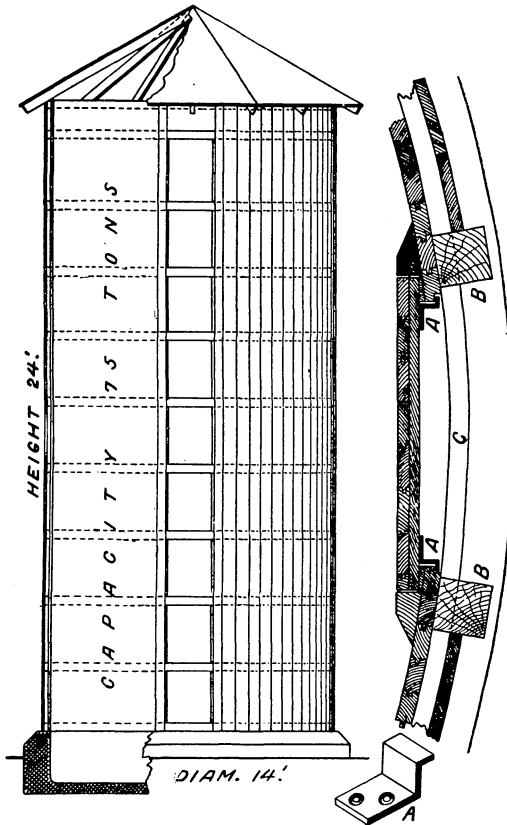


FIG. 25.—A 75-ton silo with wooden hoops.

DETAILS OF SILO CONSTRUCTION.

Figure 26 shows details of construction for the modified Wisconsin silo. *A* is the foundation; *B*, roof construction; *C*, arrangement for laying concrete in foundation; *D*, detail of doors. In figure 27, *A* shows how doors are cut from the staves when not made continuous; *B* shows general arrangement of continuous doors for stave silo.

DAIRY HOUSES.

Figure 28 shows a dairy house 10 by 12 feet, suitable for a dairy of about 20 cows. *A* is the drip board; *B, B*, wash trays; *C*, water heater; *D*, cooling tank; *E*, platform for receiving and delivering milk.

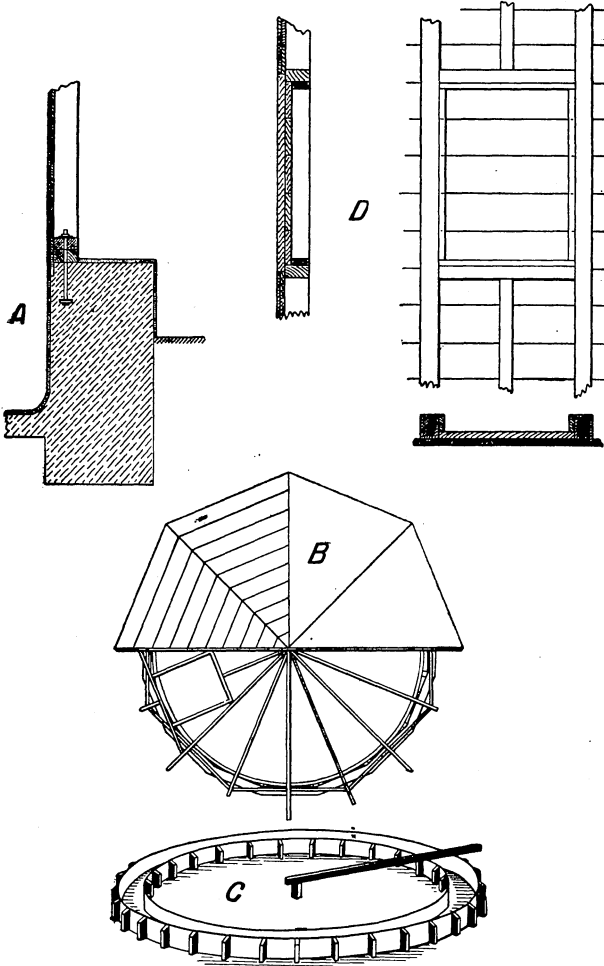


FIG. 26.—Details of construction of modified Wisconsin silo shown in fig. 24.

Figure 29 shows a dairy house for a small certified-milk plant. *A, A* are coal bunkers; *B*, boiler; *C*, sterilizer; *D*, shower bath; *E*, bottling table; *F*, cooler; *G*, receiving can.

Figure 30 shows a small dairy house suitable for the general needs of a herd of 25 to 30 cows. *A* is the ice box; *B*, butter worker; *C*, heater; *D*, churn; *E*, cream vat; *F*, trap to sewer; *G*, cooler; *H*, separator; *I*, can and pail rack. If this house is built of wood the brick chimney should be built outside the frame.

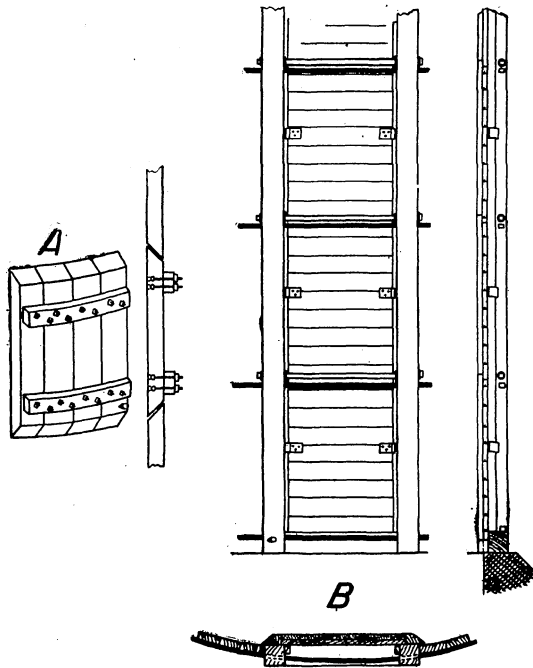


FIG. 27.—Details showing construction of single (A) and continuous (B) doors.

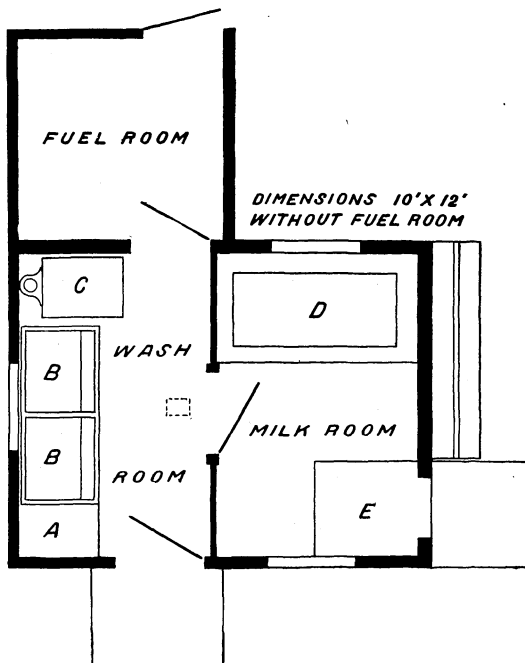


FIG. 28.—Floor plan of small dairy house suitable for dairy of 20 cows.
[Cir. 131]

In the plan as shown *A* is the pump; *B*, boiler; *C*, ice machine; *D*, engine; *E*, skim-milk weigher; *F*, churn; *G*, sink; *H*, milk vat; *I*, weighing tank; *K*, separator; *L*, cream vat; *M*, table.

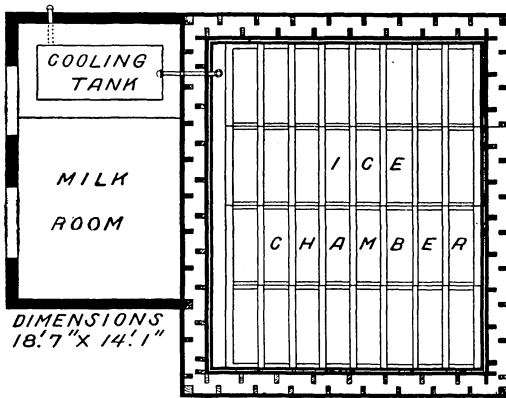


FIG. 31.—Floor plan of small ice house and milk room.

CREAMERY FOR CITY MILK COMBINATION SERVICE.

Figure 34, floor plan, and figure 35, front elevation, show a building designed to accommodate a combination of creamery and city milk service, with modern equipment for the best practice.

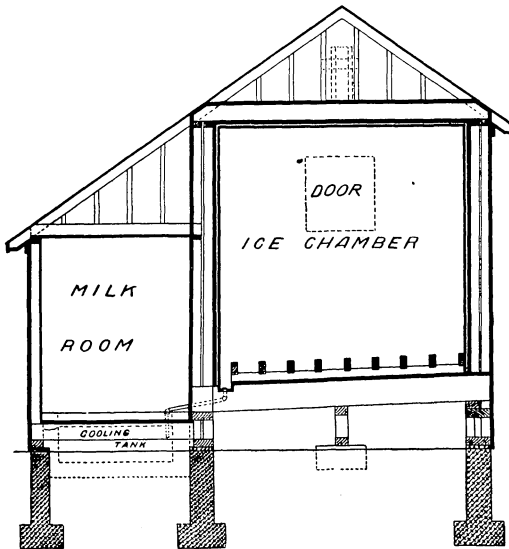


FIG. 32.—Cross section of ice house and milk room shown in fig. 31.
[Chr. 131]

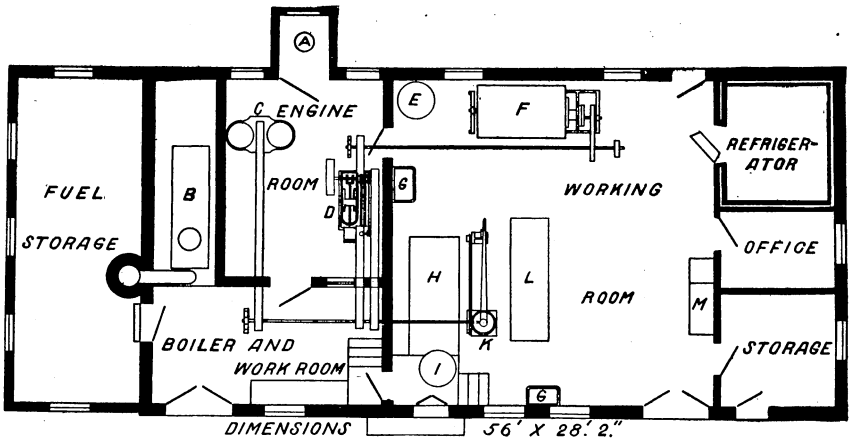


FIG. 33.—Floor plan of creamery for whole milk.

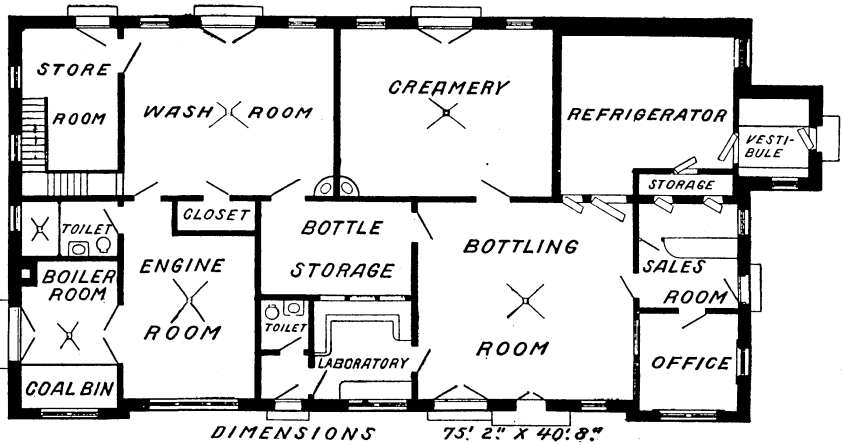


FIG. 34.—Floor plan of creamery and city milk plant.

FIG. 35.—Front elevation of creamery and city milk plant shown in fig. 34.
[Chr. 131]